National Aeronautics and Space Administration

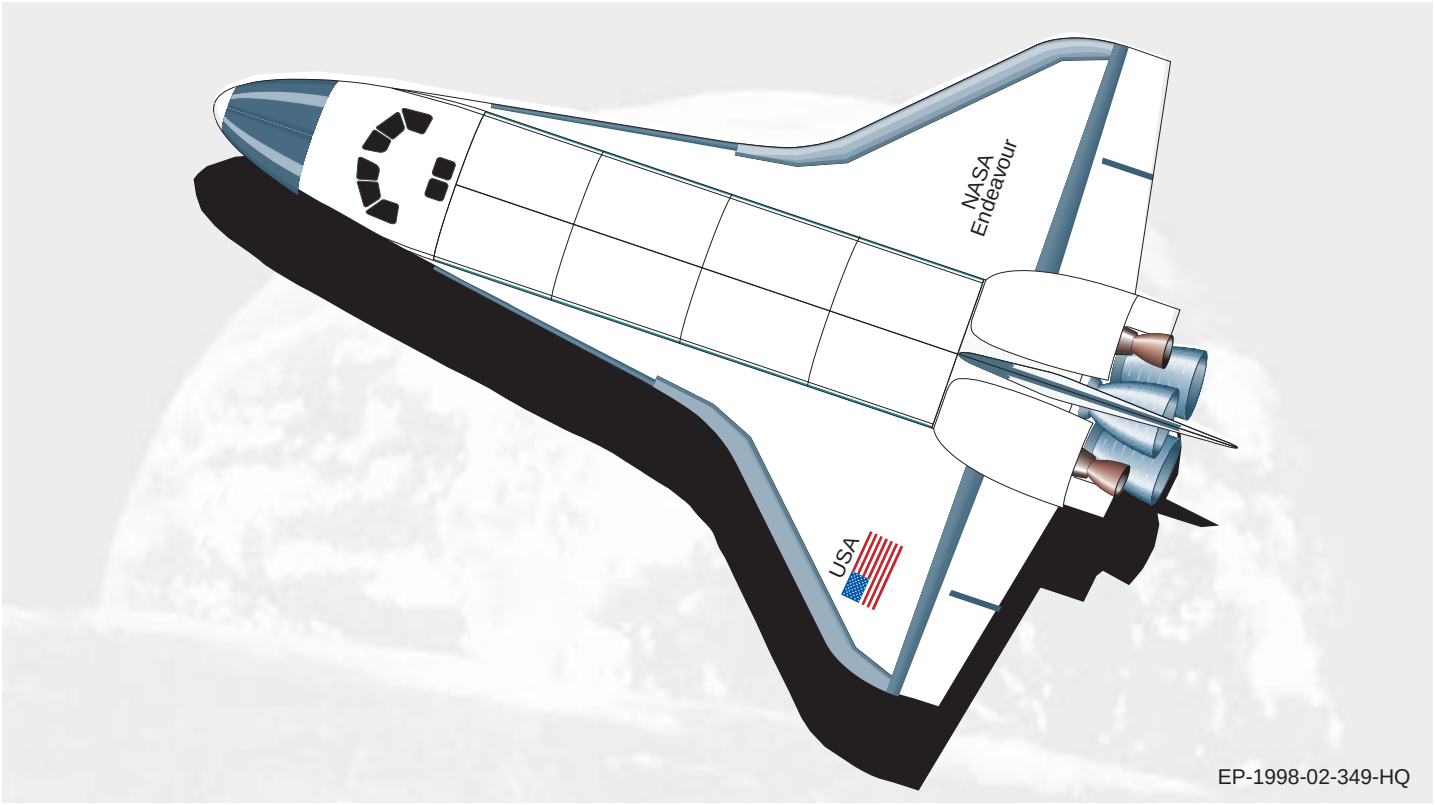
Educational Product	
Teachers & Students	Grades 5–12

Space Shuttle Glider

Your Space Shuttle glider is a 1:300 centimeters scale model of the U.S. Space Shuttle orbiter. The airplane-like orbiter can remain in Earth orbit for up to two weeks at a time. It normally carries a six- to seven-person crew—the mission commander, the pilot, and several mission and/or payload specialists who have specialized training associated with the payloads and experiments being flown on that mission.

The Space Shuttle system is very versatile in the types of missions it can perform. Some missions involve the deployment, servicing, or retrieval of payloads, like communication satellites or orbiting observatories such as the Hubble Space Telescope. Other missions may carry the pressurized spacelab module, which sits in the payload bay. Through an access tunnel, astronauts enter the spacelab where they conduct numerous experiments on the effects of weightlessness on various materials and human beings. Shuttle missions can also carry scientific instruments capable of making astronomical observations or studying Earth's changing environment. At the end of a Shuttle mission, the orbiter is piloted back to Earth and lands like an airplane on an airstrip. It is then refurbished so that it can fly another mission. NASA anticipates that each orbiter will be able to fly at least 100 missions.

The orbiter and its engines are just part of the Space Shuttle system. The other parts (not modeled here) are the solid rocket boosters (SRBs) used for launch and the external tank that contains 1,900,000 liters of liquid propellant for the three Shuttle main engines. All of the parts are reusable, except the external tank, which is jettisoned just before the Shuttle achieves Earth orbit. This ability to reuse costly equipment, as well as the ability to conduct missions from Earth, will substantially decrease the cost of space operations. During our Earth-bound years we relied upon trucks, trains, and airplanes to provide transportation; now we rely upon the Space Shuttle to provide transportation to and from space.



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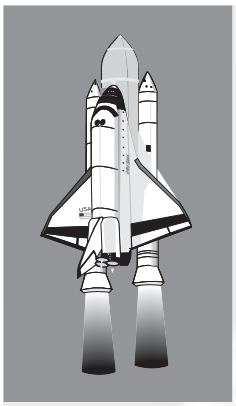
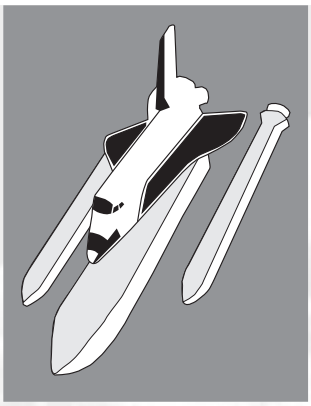
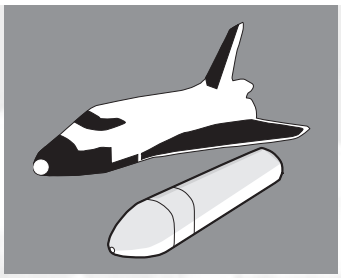


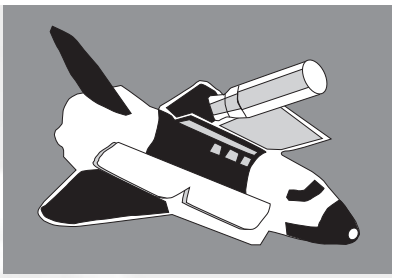
LAUNCH



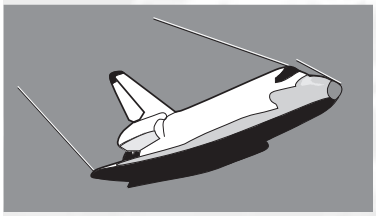
BOOSTER SEPARATION



EXTERNAL TANK SEPARATION AND ORBIT INSERTION

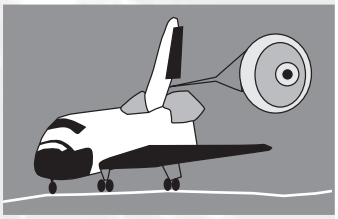


ON-ORBIT OPERATIONS



RE-ENTRY

Space Shuttle Glider Assembly Instructions



AIRSTRIP LANDING

Space Shuttle Glider Assembly

Tools Needed:
Scissors
Ruler
Dull knife (butter knife)
Stick glue or white glue
Cellophane tape (optional)

Procedure

Step 1. Cut out the entire pattern on the outside lines. The more careful the cutting, the better the finished glider will look.

Step 2. Line up the ruler with the dashed fold lines. Pull the dull knife along the lines to score them. This will make folding more accurate.

Step 3. Fold the paper on all dashed lines. The dashed line will be up for a mountain fold and down for a valley fold. See figure 2 below for details on the folds.

Step 4. Lightly cover both pieces of nose strut 1 with glue. Fold it over the nose of the glider to form a triangle shape. Bend nose strut 2 over and press to strut 1 until the glue holds. See figure 1.

Step 5. Coat the inside of each wing with glue and press top and bottom together. Be very careful to line up the parts. See figure 2.

Step 6. Coat the inside of the tail pieces with glue. Also coat the outside of the four flaps along the payload bay with glue. Bring the two sides of the payload bay together so that all flaps slide *inside* the glider. Lightly press the payload bay and the tall pieces together until the glue holds.

Step 7. Coat the inside surface of the nose on each side with glue and press them to the struts until the glue holds. If you wish, strengthen the nose with a small amount of cellophane tape.

Step 8. Put a small amount of glue on the inside of the tiny triangle at the nose of the glider. Bend it upward to close the hole. As the glue dries, the triangle will stay put.

Flying the Space Shuttle Glider

When the glue is dry, your glider is ready for flight tests. Depending upon how much glue you used, the glider may already be balanced for flight. Gently toss the glider forward with its nose slightly elevated. If it flies smoothly and lands flat on its bottom, the glider is ready. If not, it may be necessary to add a small amount of weight to its nose. Ball up a small piece of tissue paper and push it into the nose from the tail end of the glider with a pencil. Keep adding small pieces until the glider flies properly.

Space Shuttle Glider Challenges

Challenge #1 — Determine the Scale of the Glider

Needed: Space Shuttle Glider, metric ruler, and calculator

What To Do: Measure the length of your glider in centimeters. Divide your answer into the length of the real Space Shuttle orbiter to determine your glider's scale.

Space Shuttle orbiter Length: 3,724 centimeters

Challenge #2 — Glide Ratio

Needed: Space Shuttle Glider and tape measure

What To Do: Gently launch the Space Shuttle Glider horizontally from a measured height above the floor. Measure how far across the floor the orbiter traveled from the launching point. Determine the glide ratio of the glider by dividing how far it traveled by the distance it dropped to the floor. Research the glide ratios of other aircraft such as commercial jets, small private planes, and sail planes.

Challenge #3 — Fishing Line Guidance System

Needed: Space Shuttle Glider, paper clips, nylon fishing line, cellophane tape, and book.

What To Do: Spread open two paper clips so that they become "S" hooks. Bend the lower end of the S for each hook straight out. Attach the straightened ends of the paper clips to the back of the glider with tape so that one clip is in the nose and one is in the tail. Tie one end of the fishing line around the book and set the book on the floor. Stand back several meters from the book and hold the other end of the fishing line about one meter above the floor. Hook the glider on to the fishing line and let it go. Try to get the glider to land on the floor without running into the book.

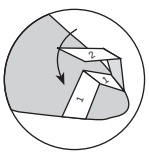
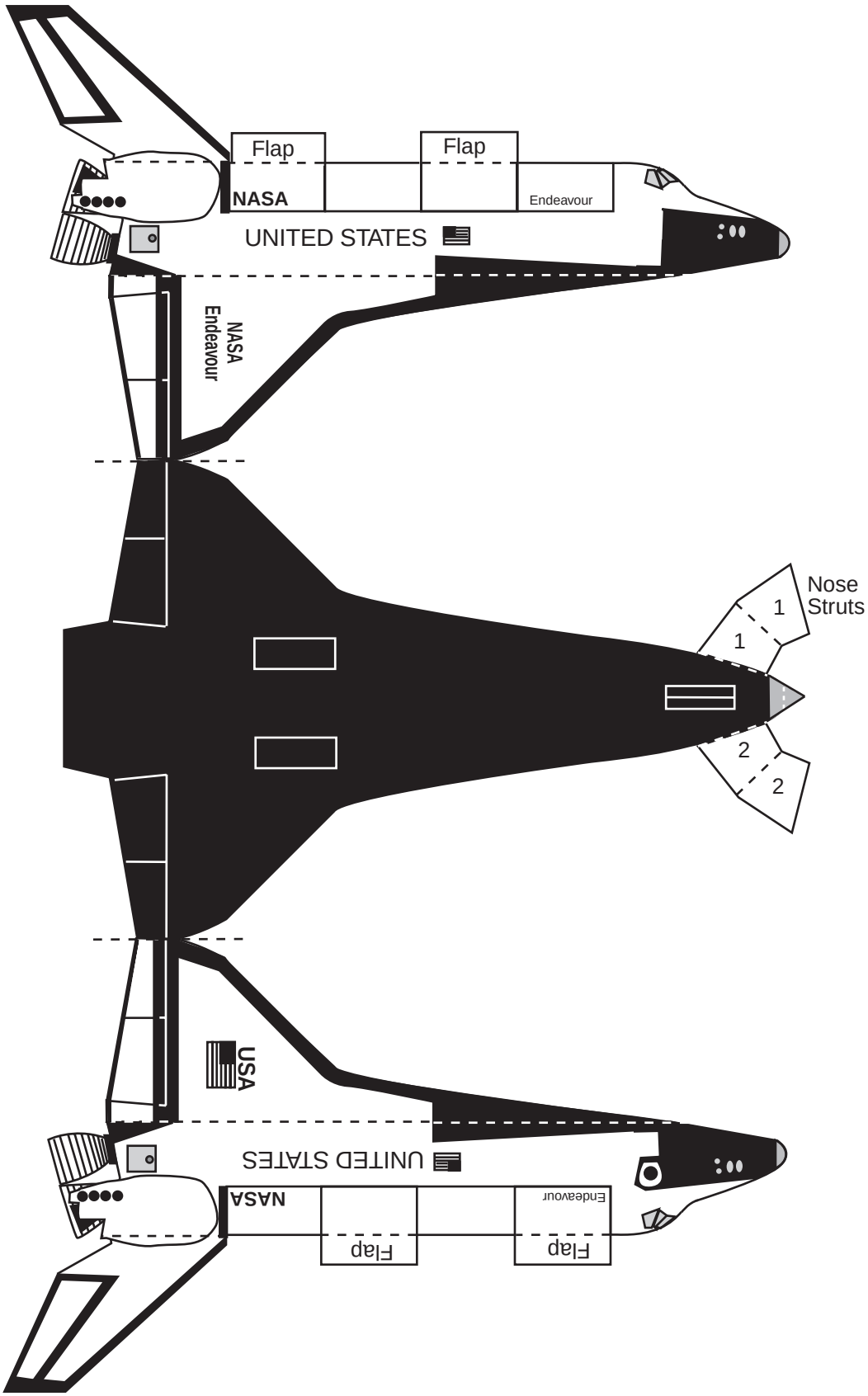


Figure 1

Figure 2



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